Summer 2010

Driving Retail Sales Through Effective Supply Chain Management Technology

James Haws
Regis University

Regis University
College for Professional Studies Graduate Programs
Final Project/Thesis

Disclaimer

i

DRIVING RETAIL SALES THROUGH EFFECTIVE SUPPLY CHAIN MANAGEMENT TECHNOLOGY

A THESIS

SUBMITTED ON 25th OF July, 2010

TO THE DEPARTMENT OF INFORMATION TECHNOLOGY

OF THE SCHOOL OF COMPUTER & INFORMATION SCIENCES

OF REGIS UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF MASTER OF SCIENCE IN

COMPUTER INFORMATION TECHNOLOGY

BY

James Haws

APPROVALS

Ali Asgari, Thesis Advisor

Shari Plantz-Masters

Douglas I.. Hart

Abstract

Supply chain management coordinates the production and distribution of a product with the goal of increasing profitability and productivity. Advancements in technology and workflows in recent years have enabled distributors, suppliers, and retailers to operate more efficiently and effectively. Although significant technological advancements have been made in supply chain management, inventory management still causes a number of problems for retailers. The average out-of -stock rate nationally is approximately at an 8% level (Corsten & Gruen, 2003). Inadequate inventory management can reduce retail sales, drive up costs associated with transportation and storage, decrease customer loyalty, and ultimately lead to a significant loss in revenue for the retailer.

RFID is an emerging technology that has recently begun to emerge as a tool to improve supply chain management and logistics in the consumer packaged goods industry. While the technology has met resistance in its implementation, its benefits still show promise in its ability to improve communication and workflows.

The purpose of this study is to establish the need for increased information system technology in the purchasing, merchandising, and distribution practices which are currently being utilized by retailers and mass merchandisers. This study will analyze current distribution and supply chain frameworks and determine the most efficient and cost effective measures that organizations can implement to the supply chain and determine if technology such as RFID can be more efficient and produce an acceptable return on investment.

Acknowledgements

I would like to acknowledge my family for their support and encouragement. I would also like to thank the McLane Company for their guidance and resources throughout my research.

Table of Contents

List of Figures

List of Tables

Chapter 1 – Introduction

Supply chain management is a multiple level tool of understanding which provides a retailer the opportunity to manage all costs associated with raw material sourcing, manufacturing, handling, storing, and redistribution of product. Supply chain management plays an integral part in improving the effectiveness which organizations manufacture and deliver products to business partners and consumers. The ultimate goal of effective supply chain management is to provide the consumer with the product that they want, when they want it, and at a competitive delivered price.

There are numerous tools and processes utilized by retailers in supply chain management including Universal Product Code (UPC), Vendor Managed Inventory (VMI), and Handheld devices (Smart handheld).

The most common tool of a replenishment system is the Universal Product Code or UPC. UPC provides a standardized method for identifying products and product description. They allow retailers to keep track of products that the retailer receives and sells. UPC helps improve on-hand quantities and track products moving in and out of the store.

Many retailers have also utilized additional inventory mechanisms, including Vendor Managed Inventory, or VMI. VMI is the process where the vendor manages the inventory and replenishment of the retailer's inventory. VMI was designed to improve the product flow between the vendor and retailer. Some retailers also incorporate a handheld device, these are portable computers and order transmission devices. Handheld devices allow stores to manually update inventory levels and order product.

Recently, more advanced technology has emerged in the consumer packaged goods industry. An example of this is Radio-frequency Identification (RFID), which allows a product to be tracked by radio frequency. Starting in June 2003, the Wal-Mart company requested that its top 100 suppliers place RFID tags on pallets and cases that were shipped to stores in Dallas, Texas. Many retailers such as Target, Best Buy, and Albertson's followed suit, and many manufacturers began to implement the technology within their products (Read, 2004).

RFID technology has the potential to revolutionize the consumer product industry, but also contains monumental obstacles that need to be overcome to realize its full potential. While RFID promises new and efficient ways to distribute and control products within the Consumer Packaged Goods (CPG) industry, there remain a number of questions that must be resolved before the technology is completely adopted by the industry. RFID must present an accepted ROI formula that proves that it is accepted by all levels in the supply chain. ROI formulas vary by company, but normal business practices call for any capital expenditures to either maintain or improve the company's return on investment goals. Simply stated, corporations are keenly aware of how Wall Street evaluates their expenditures for any asset, including technology. Usually the higher and faster the return on investment equates to higher stock ratings and the resulting higher stock valuation. Privately held companies might be judged to be worth more in the event they were to be sold. The issues with RFID are further complicated by the return rate which can vary by market segment; a manufactures ROI requirement may be different than a distributors or retailer due to industry standards and competition. "Best of class" always tends to set hurdle rates for each segment. Additionally, all levels

must decide upon a common and efficient hardware configuration. The data that is collected and assigned to products must also be managed and defined. Current legacy systems must also be taken into account and the process of implementing the new technology must be defined in a consistent framework. Finally, RFID must create standards and concepts that can be applied throughout the business world including international networks and supply chains (Poirier, 2006).

This paper will look at the current state of RFID technology in the Consumer Packaged Goods industry. It will look the benefits and barriers to implementing the technology across the industry. The paper will conduct a study that will look at a major distributor in the consumer packaged goods industry, the McLane Company. The current distribution model and technology used by the organization will be discussed and analyzed. Fill rates and replenish processes using barcode technology will be discussed to determine if a new technology such as RFID tags would improve fill rates, location, tracking, and efficiency. The study will provide the industry insight into the benefits and obstacles into implementing RFID across a large scale.

Listed below are the questions this thesis will address.

Research Questions

- What is the current distribution model used by the McLane company?
- What method is currently implemented for product and item location?
- What are the results and fill rates of using a Vendor Managed Inventory VMI system?
- What is current process for replenishment to stores?
- What are the current uses for Smart Handheld devices?

- How does RFID technology improve the distribution process and workflows?
- What are the barriers to implementing an RFID system?

Chapter 2 – Review of Literature and Research

The concept of Supply Chain Management (SCM) has been studied for decades. Moving products effectively from production to the end user has been studied and analyzed by manufactures, distributors and retailers, all attempting to improve the process. The term "Supply Chain Management", became popular in the late 1980's within the business world. is defined as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (Metzer, 2001).

The supply chain is operated by a number of components and organizations. Each component is responsible for different functions, with the end goal of delivering a final product to the consumer effectively and at a low cost. The companies that participate in the supply chain include producers, distributors, retailers, and the consumer. Producers are typically the manufactures of a product. They make a product out of raw materials and package the product for consumption. Distributors are organizations that are the middleman between the manufacturer and retailer. A distributor will receive and store products from a large number of manufacturers and will deliver or replenish the product to retailers depending on the retailers need. Retailers sell products directly to consumers. Retailers will advertise products and promotions to attract consumers to their stores. Consumers are the typically the end user of the product (Hugos, 2006).

There are a number of factors that drive the supply chain. These include production, location, inventory, transportation, and information. Production includes the

actual manufacturing of a product, quantity produced, and balancing the production capabilities while still maintaining quality. Inventory management focuses on two important aspects, customer service and cost control. Inventory management helps decide how much inventory should be stocked during every stage of the supply chain. Inventory can be costly to hold, but must also be readily available, therefore a balance of levels must be made to ensure the most optimum level. Location in supply chain management determines the location of production and inventory. Organizations must ensure that the location of the facilities provide efficient transportation for delivery to retailers and consumers. Transportation involves what method is utilized to move the product through the supply chain (truck, train, aircraft, etc.). Information is another important aspect of supply chain management. Data must be collected and shared to ensure proper management and logistics (Hugos, 2006).

In order for supply chain management to work effectively, information must be gathered and stored throughout the management chain lifecycle. When large amounts of products are produced and distributed throughout the supply chain, it is essential that these products can be identified effectively and efficiently. In order to manage and maintain information and data, products are provided with an identification number or product identification code. This code can identify a product quickly and efficiently and allows organizations to collect and share data (Hugos, 2006).

For the past fifteen years the most popular product tracking standard has been the Universal Product Code or UPC. The first bar code was introduced in 1952, by Joseph Woodland and Bernard Silver. The bar code was not used commercially until 1966. Starting in 1970 the first industry standard was introduced. It was called the Universal

Grocery Product Identification code or UGPIC. Three years later, the UGPIC became what is now known as UPC. The first product to be used at a retail store occurred on June, 26, 1974, when a 10-pack of Wrigley Juicy fruit gum was scanned using a hand held scanner at Marsch Supermarket in Troy, Ohio. Since its original scanning in 1974 UPC bar codes have been used to scan billions of products at retail stores (Albert, 2007).

The introduction of UPC in the retail industry quickly transformed the way the CPG and grocery industry managed their business. Standards were created in UPC barcodes and the system grew into a global system called the GS1 System. The GS1 system is used by millions of companies in over 140 countries (Barcodes, 2010).

UPC product codes are created by a not-for-profit company called Uniform Code Council, or UCC. The organization develops worldwide standards for identification codes and electronic commerce. A UPC barcode symbol includes a black and white bar code consisting of vertical black bars and white spaces in-between. In addition to the black and white bar code, numbers are located at the bottom of each bar code symbol. The distance between the vertical bars and the thickness of the black vertical bars contains the numbers in the barcode. Each barcode contains two black bars that identify the beginning and the end of the bar code (Barcodes, 2010).

When an organization requests a product to be entered in the UPC system, the UCC will issue the manufacturer a specific identification number. The GS1 Company prefix is a unique code that contains a numerical sequence of anywhere from seven to eleven numerical digits which then are licensed to the manufacturer for a single item. A Legal Entity GLN is also assigned to the manufacturer that identifies legal descriptions and functions (Uniform Code Council, 2010).

The use of UPC codes actually began in the early 1970's as a technological solution for large supermarkets trying to price goods. Supermarkets were spending millions of labor dollars annually, paying workers to work nights affixing adhesive type labels to every "store keeping unit" or" SKU" which they stocked. Items that were refrigerated or frozen posed special problems for adhesive labels. Night labor was paid a premium shift differential and there was also a higher percentage of employee turnover; thereby increasing hiring and training costs. It was made even more difficult, as the pricing of many goods are driven by the constantly changing commodity markets, and also other factors such as; freight costs, labor strikes, weather, manufacturing promotional activity, and competition Supermarket profits depend on their ability to quickly raise prices on items that have gone up, thereby creating inventory profit gains. The reverse situation when prices fall also creates the need to maintain competitive pricing to protect market share. Pricing integrity is an important factor for customer retention. Sale or Promo items also drive price change needs. Wednesday became the main newspaper advertising day for supermarkets to run their weekly specials, so all promo items had to be marked down on Tuesday night. Situations arose where the same product in the same bin had more than one price, or there were numerous incidents where the new price label did not quite cover the old price, triggering the infamous public announcement, "Price check in aisle 3 please"(Grogman, 2009).

Supermarkets liked the premise that a unique numerical barcode would be made for every item produced and easily printed on the existing label or exterior packaging. The UPC process, although tedious in start up, quickly gained a loyal following because of the high return on the investment. Like any major technological change it created new

challenges, the scanners were expensive and worked well when the UPC code was easily displayed, but some items with reflective qualities such as water or clear juices reflected back the scan resulting in a “no read” and slowed the checkers. Other times the scan bar was unable to read anything, as the enclosed glass screen was dirty, because of wet produce or leaking containers. Training techniques for check-out personal had to be included in the program. Other issues that challenged the program were items made overseas that were not participating in the UPC program, these vendor partners had to adhere to the standards or be culled from the SKU mix. There were also items that had the UPC code but inside the carton there was more than one saleable unit. Many times these individual items did not have a UPC code, so someone buying one Snicker Bar, might inadvertently, pay for a box of 36. These situations also led to overstock issues when supermarkets started using UPC codes for replenishment, as sometimes there was confusion between eaches, boxes, and cases (Grogman, 2009).

The success of UPC technology also accelerated the acceptance of the VMI process which was mentioned earlier. There had been a huge increase in the number of products that were manufactured by one corporation, as well, as high volume SKU’s, which represented high percentages of daily sales. Proctor and Gamble, as an example, supplies thousands of items in many categories to a supermarket. It has products in almost every aisle and might control 15% to 20% of the total items stocked. This type of mega-penetration leads to the mutual need of being “in-stock” and also being on the same page when it comes to marketing and advertising. VMI insures that a supermarket chain will have the information to promote certain items at the same time the manufacturer is using a variety of media events to create demand. The price that is charged is always, by

law, determined by the retailer. The supermarket or big box store must have a firm written agreement in place which spells out measurable parameters that must be adhered to. Main elements include; dollar inventory levels by day, week, and month, and cover holiday and seasonal items. Inventory goals must also be negotiated to maximize inventory turn to free up capital from slow moving inventory. The manufacturer also benefits by manufacturing on a "just in time" atmosphere which "frees up" its capital as well, and allows it to operate more efficiently. Shipping parameters must be decided to maximize both parties' logistical needs and sometimes enables a retailer to fine or charge back a vendor for failing to perform. Finally there needs to be a written description of how and when "on-going dialogue" is to take place. A manufacturer always wants more shelf space and more of its SKU's displayed, a retailer wants to stock what consumers want and also what produces the largest profit. VMI has evolved into a basic tenant of successful "major retail players" (Grogman, 2009).

While UPC has been used in the majority of CPG supply chain management product coding, a new technology called Radio frequency identification or RFID has recently began to gain momentum. The beginnings of RFID can be traced back to World War II. The United Kingdom applied RFID type devices to identify airplanes returning from a mission. Previously, radar could only detect incoming aircraft, but not the country of origin. The application for using the technology began advancing in other industries about 30 years later. The supply chain has been a particularly strong market for RFID and its technology. In 1974, a group of European organizations came together to develop a standard number system similar to the UPC standards that were established in the United States. The resulting organization became known as European Article Numbering

International or EAN. In 1999, steps were taken to form a global network that would standardize RFID in the supply chain. The UCC and Procter and Gamble began funding the Auto-ID Center, which is based at the Massachusetts Institute of Technology in Cambridge Massachusetts. The major goal of the Auto ID Center was to create inexpensive RFID tags that could be used in consumer goods. The tags would allow a network to collect and share information about products that had a RFID chip installed. The Auto-ID Center plans to create a network that would become "An Internet of Things": and allow the ability to share and locate items throughout the network. The Auto-ID center is comprised of 100 global companies and seven universities from around the world. The center focuses on creating cost efficient standards, and future proofing the EPC Network Infrastructure. This will allow the industry to grow and support future applications and advancements in technology (Poirier & McCollum, 2006).

The interest in RFID continued to develop in the CPG industry, Wal-Mart in 2003 announced new mandates for RFID implementations. Wal-Mart required that its top 100 suppliers must apply RFID labels to all of its shipments. Early adopters of RFID found it difficult to implement the system in their current legacy and supply chain management systems. Many manufacturers implemented manual processes which made it difficult to realize a fair return on investment (Duvall, 2007).

RFID Operations and Functions

RFID provides a tagging system that allows an object to be tracked, located, and identified using wireless communication. Information regarding a product or item is contained in small chips that are attached to a pallet, a shipping container, or the item itself. The information contained on the chip can be received by an RFID reader and

information can be decoded and stored on servers. The information is sent through a radio frequency and the frequency contains the products' electronic product code, or EPC. Information including the EPC is saved on the RFID chip; the chip has a miniature antenna. A numbering system identifies all items as unique. When a reader scans a RFID chip, the chip will return the items EPC. Information stored on the chip includes the code header, the EPC Manager Number, the Object Class, and the serial number. The header contains the information regarding the type of EPC including the length and type. The EPC manager number maintains and identifies the company or entity. The object class shows the class of the item. The object class is a similar practice to the SKU. Finally, the serial number identifies the instance of the object class (Poirier, 2006).

An entire RFID system consists of an RFID tag, an antenna, a RFID reader, application software, and middleware. The RFID tag can be either a read-only tag or a read/write tag. The tag broadcasts the information about the item to a reader that is requesting the item. The antenna transmits and receives data through radio frequency. Readers send a signal to the RFID tag and receive a response. The reader receives commands from the application software. In addition, the reader can provide the RFID chip with power when the RFID tag is a passive tag. The application software can be programmed to accommodate the functions of the user. The middleware is used between the hardware and application software (Poirer, 2006).

RFID chips can be active or passive. Passive chips have no internal power supply and rely on the RFID reader to provide a small amount of power to active the chip. Passive tags are cheaper and smaller because of the lack of an internal power supply. Active chips contain an internal power source which allows the chip to transmit a

stronger data signal over long ranges. The chip can also contain a larger internal memory. The internal memory and internal power source allows the tag to store data that is sent from the receiver. Active tags are larger than passive tags, but they are more powerful and have the ability to write data, making the active tags more functional (Myerson, 2007).

While there are no current universal standards in RFID technology, there has been a considerable amount of work done to develop standards for different applications. An organization called the International Organization for Standardizing or ISO created standards for tracking animals called ISO 11784. Additionally, the ISO has created standards for payment systems and smart cards. The Auto-ID center has been trying to create low-cost RFID tags for supply chain management and CPG's. The technology they began using was ultra-high frequency band or UHF. The Auto Id center also developed a protocol and licensed it to the EPCgobal. The protocol is made royalty-free for manufacturers and users. The UHF protocol was originally designed to communicate with different classes as technology advanced. Class 1 is a passive RFID tag that is read only. Class 2 is a passive tag system that has 6KB of read and writes memory. Class 3 is a semi-passive tag with a built in battery for increased readability. Class 4 is an active tag that has a built in battery and additionally transmits to a signal. Class 5 is also an active tag that can only communicate with class 5 tags and devices. Auto-ID gave its class 0 and class 1 protocol to the EPCglobal and the EPCglobal approved Class 0 and Class 1 as EPC standards (Myerson, 2007).

Class 0 and Class 1 RIFD both possess downsides. They do not work with one another and are also incompatible with the ISO standards. Both classes also operate

using two different frequencies, one that is used to send and another to receive. This issue has caused problems in some countries where regulations prohibited their use. A new protocol was introduced in 2004 that included a second generation of RFID tags. The tags were developed to work within ISO standards, but were not compatible with previous generation 1 and 2 classes (Myerson, 2007).

RFID in Consumer Packaged Goods

Using RFID in the CPG industry is a relatively new concept. The idea took a large leap when Wal-Mart, the world's largest retailer, began to mandate that the supplier begin to use RFID and Electronic Product Codes to track pallets and cases. Wal-Mart met with its top 100 suppliers and introduced the concept of RFID and requested that suppliers begin using the technology for distribution to its stores. Their RFID strategy was announced in 2003, and top suppliers were mandated to tag all pallets by 2005. The goal included adding the next 100 suppliers to the mandate every year. Wal-Mart believed that a transition to RFID would improve efficiencies in logistics, improve out-of-stocks, and improve sales (Supply Chain Digest, 2009).

Although Wal-Mart gained support from some suppliers such as Proctor and Gamble and Unilever, many suppliers have been slow in achieving implementation. Seven years after Wal-Mart's initial mandate, only 600 of their 60,000 suppliers have been able to adapt to the changes. The ROI has been debated among suppliers. An average low cost RFID tag costs 10-15 cents. Compared to the standard bar code, this is relatively high, particularly among item level tagging. This makes it difficult for suppliers to invest. Wal-Mart is not the only retailer to have difficulty implementing an RFID strategy. Retailers such as Albertsons, Best Buy and Target have all tried test pilots using

their own RFID programs, but have scaled back implementation because of high costs and other difficulties, similar to what Wal-Mart experienced (Duvall, 2007).

In 2007, Wal-Mart scaled back its implementation of RFID. Instead of having all pallets tagged with RFID, they focused on shipments to Sam's Club (Wal-Mart's Wholesale chain). They also focused on promotional displays and products in Wal-Mart retail stores, and began to test the impact of the technology in improving category management in some departments (Supply Chain Digest, 2009).

Wal-Mart is still pushing forward with its mandate for suppliers to comply with its RFID system. Beginning in January of 2008, Wal-Mart charged suppliers with a $2.00 fee for every pallet that was not tagged with an RFID tag shipped to Sams Club (Weier, 2008). The charge covered the cost that Wal-Mart had to pay in order for the company to affix a tag. Additionally, Wal-Mart announced plans to implement pallet level tagging in 17 distribution centers by 2008, case and mix pallet tagging by 2009, and selling-unit tagging in all distribution centers by October 2010 (Duvall, 2007).

Benefits of RFID in Consumer Packaged Goods

RFID technology has a number of benefits over the current barcode system which is currently used in the CPG industry. RFID technology has benefits that include reduced warehouse and distribution costs, reduced point of sale costs, increased inventory accuracy, reduced theft, and reduction in out of stock items at retail. RFID also provides the benefits of allowing a product or item to be tracked in a real time basis as it progresses through the supply chain. Items can be tracked using an RFID reader, which eliminates the need to physically scan an item with a handheld scanner. A RFID can also scan multiple items at the same time, eliminating the need for a barcode scanner that

scans items individually. RFID tags can also hold and store much more information than a traditional barcode system. Some RFID tags can read and write data allowing information to be recorded, tracked, and changed through the supply chain (Poirier, 2006).

According to a survey by Aberdeen Group in 2007 the top objectives of RFID in manufacturing included asset tracking, production efficiency, supply chain visibility, raw materials management, mandate compliance, and finished goods inventory control (Zebra, 2007).

In relation to retail stores, RFID technology can greatly reduce out of stock items and provide better visibility of products within the store. Out of stock items are still major factors in the loss of sales at store level. Ensuring that an item is in stock and available to a retailers' customer is extremely important to many organizations. For example Wal-Mart currently has its store divided into multiple departments with each managed by a department manager or zone manager. Every day, Wal-Mart protocol requires their manager to scan out of stock item slots with handheld computers, called Telxons. The Telxon will inform the manager if the item is really in stock in the backroom. If it is, the manager will add the item to the "pick-list". The pick-list will then be used to notify a backroom inventory specialist to select the item and place it in the sales slot as soon as possible. If the item is not in the located in the backroom, the handheld unit will tell the employee that the inventory is not located within the store. The device will inform the employee that the product is in transit, or needs to be ordered from the distribution center.

This Telxon system provides an adequate way to measure and adjust quantities, but there are some problems within the system. On-hand inventory can be inaccurate caused by issues such as; theft or "mis-ships" (items received are mislabeled or the received quantity was inaccurate). Therefore the inventory system shows available product that is not really in the store. This issue becomes more complicated as the reenlistment process is reordering based on a wrong inventory level. Another common problem is when a product is displayed in multiple departments or checkout registers. When an item has multiple placements, an item might be out of stock in some locations, but not in others. An example would be a frontend checkout display in a mass retailer. A retail store might have a plan-o-gram which instructs the store to display the same items on ever checkout station. If these items are located on regularly open registers, they will quickly run out of stock. These same items that are displayed on seldom open checkout registers will carry excess inventory. Many systems such as Wal-Mart use a replenishment program based on average sales of items, insuring that inventory levels are replenished without having a large amount of back-stock inventory. When a high traffic register is used, the inventory is depleted and not automatically restocked. Therefore these systems using average sales or point of sales are not replenished correctly. These issues can lead to an on-going problem, creating mainly out of stocks, unless the system is corrected manually by a store employee.

Accurate forecasting and customer specific marketing is another benefit of RFID. According to a study by Auto Id, using the technology can improve demand planning forecast accuracy by 10-20%. Planning and forecasting are important to every organization because they reduce out of stocks, lower the risk of unsalable items, reduce

excess inventory levels, and improve efficiencies in distribution and other related costs (Smith, 2002). The reduction of inventory costs for the manufacturers from RFID can provide enormous savings both in "inventory on-hand" as well as reduced "finished inventory". It is exciting to think that finished goods can be sent directly to wholesalers or in some case to the retailers themselves. This process would eliminate the need for regional storage warehouses or mixing warehouses for companies who produce certain products in select plants and them merge or mix them in consolidated warehouse for re-shipment to usually the distributor. These freight and storage savings can be passed on to the consumer in the way of lower pricing which will increase sales.

Another advantage of RFID technology for the retailer is that the chip can identify where the item was actually purchased, thereby helping them control receiving returns from customers who purchased the product from another retailer. Returned goods cause especially large and costly problems for big box Stores like Wal-Mart, Sam's, Costco, etc as they have liberal return policies. The Labor Savings derived from RFID, does not just mean fewer checkers and support personnel but it will increase employees productivity. All retailers want to create a better, faster, and more enjoyable shopping experience to attract and maintain customers. RFID technology will provide the "perfect order" from the distributor or from the retailers own distribution centers. Currently, there are large costs associated with the issuance of credits and the resulting management of account payables, due to mis-selects, overages and shortages. McLane estimates that every credit that is written costs over $25 in labor to process (McLane, 2009). These costs can be greatly reduced or eliminated with a RFID system for all parties in the supply chain.

Unsaleable items are those that are at the wrong place, or at the wrong time, or appear damaged. An example of the latter would include; displaying snow shovels in the middle of the summer, or still having Christmas candy on the shelves in February. These types of errors bloat the inventory in terms of dollars, take up valuable space to sell fresh or current inventory, and finally necessitates the need to discount these items. Selling old or out of season inventory items also implants the idea in the shoppers mind that the store has stale product. In a study by the Unsaleable Committee, and organization made of producers and retailers, the grocery channel unsaleables were at a 1.27% of sales, which is nearly 5 billions dollars in lost sales (Smith, 2002).

Invoice accuracy is also an issue that affects accurate forecasting; what is listed as being received must be what is truly received. Products with short shelf life or have expiration codes need to be accurately forecasted to reduce waste. Inaccurate data and human error can lead to further inaccurate forecasting with the final results as either over/under supply. There are also hidden costs associated with returns and credits (Smith, 2002).

As stated previously, out of stocks within the retail store is very costly to business. According to a report by the GMA it is estimated on average that 8% are not in stock in an average supermarket. The study noted that promotional items or advertised products were out of stock nearly 20% of the time. Having out of stock items not only means lost sales, but also can lead to customer dissatisfaction, and maybe encourage the shopper to go elsewhere. According to a research paper completed by Accenture for supermarket trade, potential for lost sales of 3% per year equals nearly $12 billion dollars in lost sales revenue (Smith, 2002).

Currently many CPG companies gain forecasting knowledge by analyzing data from companies such as A.C. Nielson, Information Resources, Inc. or IRI, and organizational databases such as Wal-Mart's retail link. Many times companies will invest in other point of sale information and data made available from distributors and wholesalers. Data from resources such as A.C Nielson and IRI are typically out-of-date and based on estimates and mathematical equations. Information from organizational databases such as Wal-Mart Retail Link can be valuable, but contains a relatively narrow view as it is based on one company. Furthermore, information gathered from Retail Link may not explain why sales data changes so radically week to week. Variables such as weather, promos, and inventory levels are not included in the Retail Link data (Smith, 2002).

RFID will provide additional communication and data sharing throughout the supply chain. RFID will also allow product to be tracked in real time and throughout the sales process. Better inventory data in warehouses means higher accuracy will be communicated to manufacturers and retailers. According to Auto Id they predict that forecasting estimates can improve by 10-30% by implementing RFID technology. Additionally, Auto ID predicts that manufacturers can see a 5-30% reduction in inventory levels, 2-13% reduction in warehouse and transportation costs, 1-5% in increased sales, and 10-50% reduction in lead times. They also predict that retailers can improve shelf rate sales movement in retailers by 5-30%, 5-10% lower inventory levels, and 2-10% in increased overall retail sales (Smith, 2002).

With an RFID based inventory, system retailers have a stronger knowledge exchange and better visibility of all products within their store. A fully operational RFID

system, where every item has a RFID tag, the retailer would have accurate knowledge of all inventories and where the inventory is actually located in the store. From the time the product arrives at the store, to the moment the item is purchased by the consumer; the store could be able to monitor the inventory level and the inventory location. Additionally, the accurate inventory will cause the correct replenishment order to be placed or transmitted. The RFID system will reduce human error and eliminate current system errors.

Another benefit of RFID is active management. Active management allows for organizations not only to see the location of their product, but also the environment where it is stored. For example, an organization that manufactures a product that is temperature sensitive such as yogurt could monitor and record the temperatures throughout the supply chain. The organization would not only know that the product may be damaged or unsalable, but also be able to alert the distributor or warehouse and inform them of the problem or issue before the product is received and shipped to the retailer (Agarwal, 2001).

Theft and security is another major advantage of RFID. Barcode and UPC technology do not offer protection from theft. Security tags are often applied to high ticket items such as electronics, but that can be costly and time consuming. RFID tags can offer additional security throughout the products distribution and retail life. RFID readers can warn stores and management when products are accidently or deliberately being taken from the store. Organizations will be able to better control shrinkage by understanding the major causes on a real time basis (Agarwal, 2001).

Products with short shelf life or with expiration codes, for example milk or eggs, can be monitored to ensure they are rotated and sold before expiration. In many cases retailers fail to rotate their inventory, placing replenished items in front of older products. This can be costly to the retailer in lost sales due to expiration dates. Additionally, customers can become frustrated when they arrive home and notice that the product they purchased is expired or near expiration. This can impact customer loyalty and discourage repeat business. RFID can identify products based on their expiration data and ensure the product is properly rotated. Out of date product can then be quickly removed from shelf (Agarwal, 2001).

Product recalls and other mandates create issues for retailers, suppliers, and manufacturers. Often times, rather than pulling the batch number of a certain product, the entire product line is pulled because it is difficult or impossible to trace the specific product or batch. For example, in December of 2009, Johnson and Johnson announced a recall of Tylenol Arthritis Pain tablets. It was reported that this product had an unusual odor and there were reports of consumers becoming ill. The lack of specific information caused the recall to include many Tylenol pain relievers and also Motrin, Rolaids, and Benadryl which are also manufactured at the same plants. The total amount of product recalled included more than 54 million bottles. Some of the products were found to contain a chemical called 2, 4, 6-tribomaonisole, it is now known that the odor was traced to a chemical used to treat wooden pallets that Johnson and Johnson used to transport these items in only a few of their distributors (Berman, 2010). Recalls costs retailers and manufacturers millions of dollars in lost sales and potentially destroy an entire brand or company. Technology found in RFID can streamline the of recall process. RFID

products can be programmed to contain much greater data on each chip enabling the company to quickly zero in on a specific product rather than using the current "shotgun" process.

RFID technology has the potential to save the entire supply chain substantial amounts in labor costs. Labor costs are a significant expense in the total supply chain, contributing to approximately 30% of overall supply chain costs (Chappell, 2002). Reducing this cost can provide a large cost savings throughout the industry. Many current systems use a process of manually scanning product and location barcodes. For example, the current receiving and check-in process requires that an item or case barcode must be manually scanned and checked-in. Items are compared to a receiving checklist and labels are printed. This process can be time consuming and is prone to human error. Organizations can reduce labor costs by implementing an RFID system where labor is not required to manually scan barcodes. Cases and items that are brought into the distribution center will immediately be read, inventory amounts automatically adjusted, and the storage location of the items recorded. Items are quickly identified and inaccuracies can quickly be resolved. When the items are moved to a new location within the warehouse, the RFID tag will automatically display its new location. This will eliminate the need for an employee to scan the product and the location and eliminates the need to verify its location (Palmer, 2004). When an order is filled, employees can select items and the system will automatically adjust inventory levels and verify the accuracy of the order. When shipping, items can be loaded directly on the outbound trailer or rail car and shipped. In automated environments, the speed in which conveyers operate will increase because there is no need for lasers to scan the product's barcode. In

a study by Accenture they estimated that using RFID could reduce labor costs by between 5 and 40 percent (Chappell, 2002).

Another advantage of RFID can be found at the retail store's checkout station. Currently a typical shopping experience involves customers selecting products throughout the store and putting the items in baskets or carts. When the customer completes their shopping, they proceed to the checkout counter. Items are taken out of the shopping cart and placed on a conveyor belt; a cashier will then manually scan items with a barcode laser scanner, which is typically located on the bottom of the register. The cashier will also have a handheld scanner that will be used to scan hard to reach barcodes on larger items. This process can be cumbersome and slow and can lead to frustration. Products with damaged barcodes or products, such as water, can interfere with the scanner, forcing the cashier to manually enter the products UPC number into the cash register. This procedure can holdup the checkout process and cause delays for all customers. With an RFID checkout system, all items can be read without even taking the product out of the cart. When a consumer walks through a tunnel reader with their shopping cart, all items in the cart are automatically scanned by the RFID reader. This method can greatly improve the checkout process by reducing the time a customer waits and will improve the overall customer satisfaction rate. Additionally, the process can reduce the amount of labor needed by the retailer to operate checkouts and increase the accuracy of the order. This can save the retailer meaningful labor costs and will increase inventory turns due to improved accuracy.

Improved marketing is another advantage of an RFID system. Customer shopping habits can be tracked while they are in the store. Retailers can benefit from this

knowledge by updating their plan o grams so that related or complimentary items are displayed in areas and shelf locations that will stimulate increased customer purchases (Sharpels, 2005). RFID also allows greater sales tracking data that can be used to inform retailers of what is being sold by Zip Code, enabling stores to stock what the consumers want to buy, rather than using regional or national plan-o-grams. This increased data accuracy can also stimulate mark-downs on product before short dating or out of date occurs. Real time data also enables the manufacturer and retailer to plan "linked" promotional activity whereby a well priced popular item is sold along with a lesser known product to stimulate the weaker items sales growth, i.e.: hair conditioner linked with shampoo. Real time data also gives the retailer to quickly assess whether their current item placement, pricing, or promotional activity needs to be changed.

Obstacles of RFID in Consumer Packaged Goods

While RFID technology can benefit the consumer packaged goods industry, it faces a number of challenges and constraints that has slowed the adoption by retailers, manufacturers, and distributors. These factors include the high costs of the silicon chips themselves, as well the hardware and software needed to operate systemically with all types of chips, including "smart chips". In addition, there are a multitude of other challenges that have slowed the implementation across the CPG industry.

The high price of the RFID chip has historically been the largest obstacle in the adoption of RFID in the CPG industry. Manufacturers, retailers, and distributors have been hesitant to adopt RFID technology because it costs so much more than traditional barcodes and UPC systems. It is a gigantic task for an industry to totally change how they do business. Retailers are beginning to recognize some of the benefits that an RFID

system can have on their bottom line. It reduces out-of-stock and shrinkage, and provides a better method for managing inventory and improves forecasting. Manufacturers and distributors are also hesitant to adopt the technology; they too need to be convinced of the benefits for them, not just the retailer.

Typically an RFID passive tags cost around $0.15 - $1.00 per tag in the United States. Prices are subject to cost variations due to the technology and complexity depending on the type of the tag (Poirier, 2006). These high costs makes it virtually impossible for a manufacturer of smaller CPG's to implement the technology. For example the cost of a 3 pack of Trident White Spearmint gum is $1.41. Retailers in the CPG industry usually look for a profit margin of around 30%. Therefore the retail price of the 3 pack of gum would be 1.98, with a $0.57 profit to the store. If a RFID tag were to be applied to every pack of gum, the cost of $0.20 would have large effects on the profit margin within the store. The retail store would have to raise their prices to the consumer or the manufacturer would have to greatly lower or eliminate the profit of every item sold (Cadbury Profit Margin, 2010).

While RFID tags are not currently implemented on every individual product, they are beginning to be used in case and pallet level tagging. This method works for tracking and validates delivery, and also allows the ability to track and monitor the movement in the supply chain. Still it fails to derive the true benefits of having a total RFID tag system for inventory, security, and forecasting. Item level tagging would have to be implemented to realize the benefits of unit level handling.

Recently Auto-ID has made advancements to lower the cost of RFID tags. These tags are much less complex, and simply store the electronic product code of the product.

These chips are much smaller and much cheaper. Auto-ID believes that they can soon begin to manufacture passive RFID chips for as little as $.05 (Swamy, 2006).

The cost of individual tags is not the only barrier to implementation; there are additional costs to the supply chain. These costs involve applying the tags to the products, costs related to installing RFID tag readers in warehouses and manufacturing plants, costs associated with integration into legacy systems, cost in training employees and organization, and the cost of software and hardware solutions (Myerson, 2006).

Concerns have been concerning the ability of RFID to accurately read certain products. Products such as water, metal, and other materials have caused delays and inaccuracies because of their inference with radio signals. These products need special consideration when applying a tag because their material limits the read ranges. The following table shows the read ranges of 915 MHz signals in feet (Myerson, 2006).

Table 1: Read Ranges of Materials

	Plastic	***Metal, Direct Contact***	***Metal, .06" Stand-off***	***Glass***	***Cardboard***	***Free Space***	***Plywood***
Container insert	4.5	.5	.5	8	3.5	3.5	6
Container tag	9.5	.25	.75	5	9	13	8
Intelligent ID card	3.5	0	0	1.5	7.5	9	1.5
Reusable plastic container tag	10	1	3.5	4	6.5	6	7
Encapsulated metal mount stick tag	12.5	10	8	13	13	13	12
"Free space" tag	4	0	0	4	11	12	10
Source: Intermec.							

(Myerson. 2006)

Global acceptance of a standard is another concern among the industry. Although there have been efforts made to create standards for RFID and radio frequency there has yet to be a complete accepted standard. When dealing with a global distribution system, organizations must consider frequencies and standards throughout the world. Organizations are hesitant to invest large quantities of capital to promote a new technology when the current system of bar-coding is acceptable and already implemented.

Privacy is another major concern to the use of RFID technology in the CPG industry. Consumers and end users of a product that has been tagged with an RFID chip may be unaware of the extent technology and its many uses. When Gillette began piloting its test program within Wal-Mart, they enabled a security measure that would alert store personnel not only when restocking was needed, but also when high quantities of products had been removed that could possibly be the result of shoplifting. The consumer advocacy group Consumer Against Supermarket Privacy Invasion and Numbering, also referred to as CASPIAN, launched a campaign to alert consumer and advised to boycott Gillette products. Many consumers then became aware of the potential privacy violations **(**Poirier, 2006). Some states began looking at laws to protect consumers.

The actual implementation of a new technology into the industry is another obstacle in the adoption of RFID. The initial investment of installing hardware and software will be a significant cost to all members of the supply chain. Costs would include RFID readers, transponders, tags, and the systems and software to operate the

technology. Training and support services must also be developed and maintained. Additionally, software must be developed to insure that information gathered from the new system is gathered and stored properly so the information can be retrieved and used for business planning. The amount of data that an RFID system will collect and store will demand much greater storage capacity than the current legacy systems. Organizations must consider the amount of data that the new system will collect and store and design software to manage the information (Sharpels, 2005).

Implementing the new system will also require the industry to maintain the new system with legacy systems. While an organization moves to a new RFID supply chain system, there will be redundancies with their existing barcode system. This will require the organization to maintain two separate systems that require maintenance for a significant period of time. In addition, the two systems will require two separate operating systems for data collecting and software processes. Eventually, the new system will become the only system used, but the cost of maintaining an existing system while implementing a new system can be costly and difficult to maintain.

Chapter 3 – Methodology

In order to better understand the benefits and obstacles of RFID, this paper will conduct a study of the McLane Company. The McLane Company is a major distributor in the consumer packaged goods industry, and conducts business with some of the largest manufactures and retailers in the world. The current distribution model and technology used by the organization will be discussed and analyzed. Fill rates and replenish processes using barcode technology will be discussed to determine if a new technology such as RFID tags would improve fill rates, location, tracking, and efficiency.

The McLane Company was chosen because of their distribution depth pertaining to product mix and customer base. They allowed full access to their Colorado distribution facility. They also allowed interviews to be conducted with executives in their logistics, information technology, and operational groups located in their corporate offices in Temple, Texas. The only request which they made was the opportunity to review the thesis prior to submittal and also to use the study internally for focus groups assigned to RFID planning.

The case study was conducted by interviewing a number of McLane company employees and executive personnel over a 3 month period. Information from each department was analyzed to gain a broad overview of the company and its practices. Detailed information, regarding McLane's current distribution practices, was recorded and formatted. Time was physically spent within one of McLane's warehouses located in Longmont, Co. Operations and practices within the warehouse were recorded and analyzed. In addition, data regarding current fill rates, efficiencies, and practices were captured. Information was gathered from McLane's "Superior Execution Measurements"

which measures components of the business both internally and externally. Data such as timely delivery, order quality, and teammate productivity was gathered and analyzed. Some of the proprietary information gathered from the McLane Company, particularly point of sale data from third parties, could not be directly referenced or included in this paper.

The final section of the case study will include the recommendation for implementing a RFID system within the McLane Company. Benefits and constraints of implementing a new RFID system will be analyzed. Finally, a business strategy for implementing an RFID system will be recommended.

Chapter 4 – Project Analysis and Results

In order to understand the magnitude of implementing the new RFID system, it is beneficial to look at the distribution methods of a large wholesaler. One such company is the McLane Company of Temple, Texas. The McLane Company is a supply chain company that provides grocery and foodservice distribution to convenience stores, big box stores, restaurant chains, and drug stores. They are a $34 billion dollar organization with over 15,000 employees making it one of the largest distributors of CPG in the United States (Kimborough, 2009).

McLane Company operates 41 mega-distribution centers in the United States, one of which is located Longmont Colorado. Weekly service is provided to nearly every Zip Code in the lower 48 States, and weekly service is available to both Hawaii and Alaska via barge delivery. Densely populated areas receive daily service when needed. The customer base is divided into four basic groups of customers: Convenience Stores, Big Box Retailers, Military, and finally Foodservice. The Grocery division handles the first three categories and the Foodservice handles only national or large regional quick serve restaurant chains. The current annual volume is reported to be approximately $34 billion and the company is a wholly owned subsidiary of the Berkshire Hathaway Corporation (Kimborough, 2009).

The Grocery Division services more than 30,000 convenience stores with virtually everything that they stock, with the exception of alcohol and brand name soft drinks. These are distributed directly by the individual manufacturers. The items they distribute include cigarettes, and other tobacco products, confections, dry groceries, refrigerated goods, frozen goods, paper products, janitorial supplies, and miscellaneous

goods. The military business is similar with a heavier emphasis on cigarettes and tobacco products. The Big Box stores usually do their own distribution of the majority of their own products but rely on McLane to supplement their distribution when it is more cost effective. McLane operates over three thousand multi-temperature semi trucks, which distribute; dry grocery, fresh, frozen, and dairy products. Many of McLane's customers that self distribute use only non-refrigerated trailers, so McLane saves them millions of dollars in capital that it would cost to convert to multi-temperature equipment (Kimborough, 2009).

McLane purchases all goods centrally, with the top hundred vendors supplying VMI (vendor managed inventory) services, a central purchasing department takes the remaining items and divides them into industry recognized categories and buys and manages these accordingly. Sophisticated buying formulas are used for replacement, with high emphasis on providing 99% fill rates on all categories except for cigarettes and tobacco which McLane guarantees 100% fill rates. Many of the individual McLane customer contracts contain clauses that guarantee these high fill rates and some have penalties notated if McLane fails to provide them. These high fill rate guarantees also place enormous internal emphasis on inventory levels, as inventory turn becomes critical to McLane's profitability (Kimborough, 2009).

Most goods are delivered to McLane by truck in full truck quantities, smaller vendors or specialty goods are received in LTL quantities. McLane backhauls approximately 40% of all the goods it sells and receives goods 7 days per week in all of its facilities. Currently McLane stocks approximately 18,000 SKUs or items and sells goods in full case, break pack, or individual quantities. Items that are less than full case

receive an additional mark-up. McLane uses a sophisticated receiving process wherein all goods are scanned by Smart Handheld Devices and are given a license plate or adhesive label which is placed of every skid, identifying the manufacturer, date received, item UPC code, also a McLane code. This code can be scanned to guarantee that all goods, including imported goods are properly identified and traceable for recall/accounting reasons. All perishable products are probed to insure that proper temperature was maintained during the shipping process. Finally the license plate tells the forklift driver where to place the goods for easy retrieval for replenishment, but also places the higher moving items in locations that are the closest to the actual selection area (Grogman, 2009).

Figure 1: McLane License Plate Example

(Jones T. McLane, 1998)

Smart Handhelds are used by drivers when delivering product. The system is intended to assist drivers in making more efficient and accurate deliveries. It provides a method for drivers to verify delivery items quickly, handle credits, manage high value items, and record store deposits. The Smart Handheld can used to scan McLane barcodes

or UPC. Products can be scanned by section, by container or case, or by individual item (Grogman, 2009).

The system works by downloading load-specific billing and sales information into the delivery device. The devices are then matched to the correct driver teams by dispatchers. Information such as container count by section, total number of full cases, and number of cigarettes for the driver to match against are provided. The driver will then scan all items to verify the delivery of the product. The driver will scan return credits and manually enter deposit counts. The delivery report is printed and signed and the driver returns to the division for end day reports (Grogman, 2009).

The put-away process is accomplished using radio controlled data that is transmitted from the receiving data to dashboard mounted radio receivers on the forklifts; it instructs the operator where to put the product but also gives the process a put away priority in the event that the product is needed in a pick location quickly. The inbound data also automatically updates the available inventory which enables a real time perpetual inventory system (Grogman, 2009).

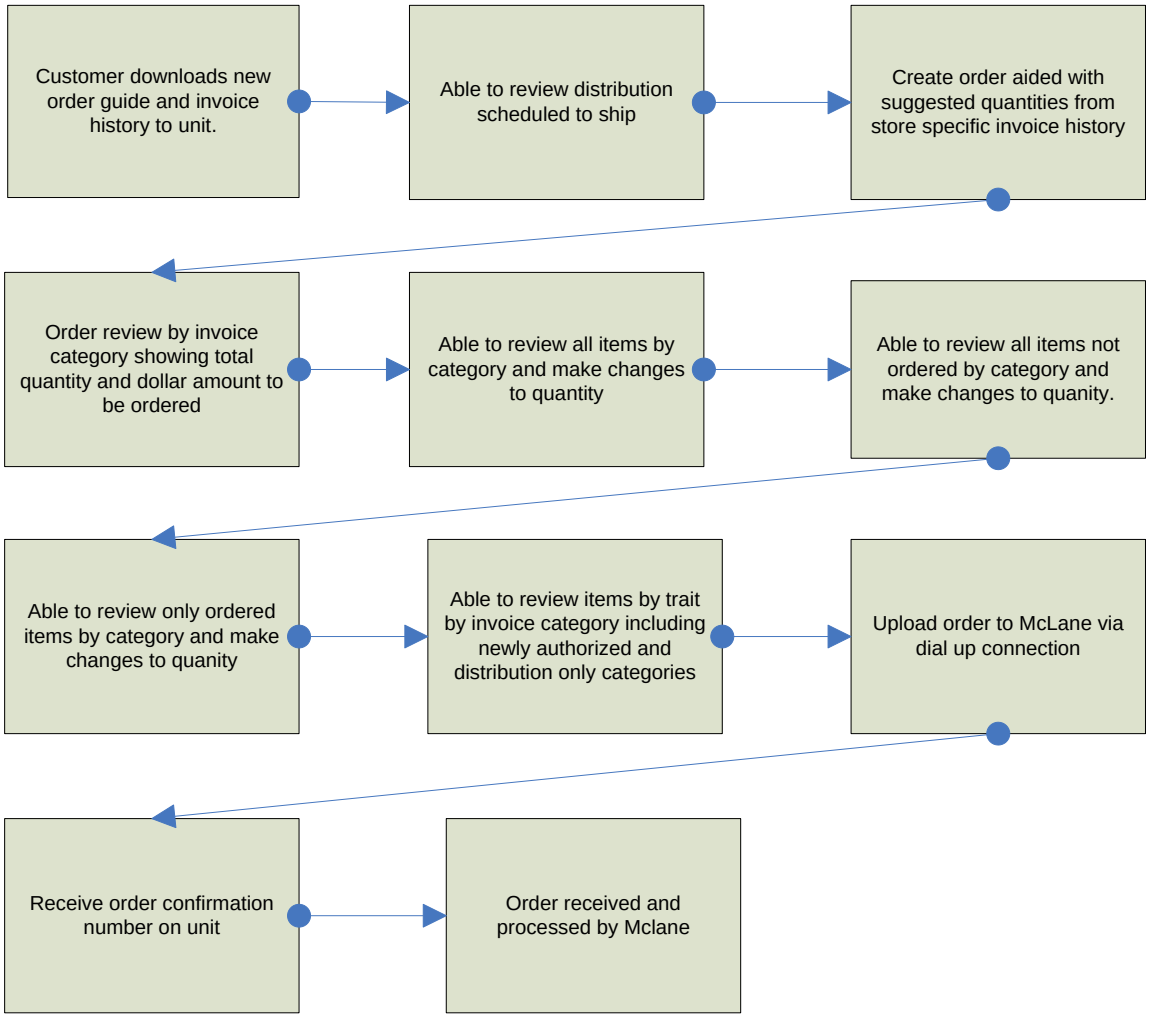
The next step is the receiving of the actual customer orders, which are received and held in an order collection data bucket and released based on a predetermined order delivery date and exact truck delivery time. These orders are placed either directly in mass EDI download communication (usually used by large national companies with their own mainframe support) or with Smart Handhelds, wherein the customer uses the device to count their existing inventory and then reorders based on a standing inventory basis, or perhaps a more advanced customized approach using historical data that the SHH provides. McLane even has the ability to provide special SHH software for a weekly fee

which enables customers to order automatically in case of power outages or other related ordering problems. Even more advanced software is available for a customer that adheres to a manufacturers program. The marketing programs might require a constant in-stock or brand depth availability program that would mean large rebates if the retailer met the programs contract (Lyon, 2010).

Smart Handhelds is a device system that McLane provides to customers. It provides an easy and efficient way for the retailer to view items and displays, as well as placing and uploading orders. In addition, the device allows the retailer to download up to date information and receive messages and communication for McLane. The device allows the retailer to scan UPC barcodes; Items can also be searched through item number and description. The system will provide a purposed order based on order history at the department and at item level. The handheld system helps improve order input quality, reduces order entry confusion, improves data accuracy, and improves the forecast based on item movement (Lyon, 2010)

Below is a diagram overview of the McLane Smart Handheld ordering process flow.

Figure 2: System Process Flow



Once the orders are received either through mass EDI transmissions or SHH transmissions, they are automatically sorted by the mainframe order processing system which assigns each individual order a specific number. This determines in what sequence the orders will be selected, loaded, and dispatched. Every customer has a predetermined delivery day and time which they selected. The next major step is the actual printing of the invoices and the selection labels which will be the guide for the warehouse staff to pick the right item. An average customer orders items which are in actually stored in seven different departments; dry full case, frozen full case, single sell, frozen/refrigerated single cell, cigarettes, and candy repack, . Therefore the selection labels are printed by

department and sent out for selection. These labels are coded with a myriad of data but the most important are: order number, load number, McLane item number, and pick location. Each selector works in a predetermined work area that might encompass anywhere from 15 to 100 feet. The selector has a glove like scanner affixed to one of their hands which has the bar code scanner on the index finger. The selector picks up a sheet of labels, scans the main order code with his finger and a light will go in the specific bin of where the item to be selected is with an illuminated number indicating the number of items to be picked. The selector picks the correct number and turns out the light, the tote which contains the product then is placed on the conveyor and moves to the next zone where the process is repeated. Finally the Tote or case has traveled thru the entire department and is then sealed and sent to the high speed sortation conveyors which merge all products from all departments. The merge operator then asks for each order to be released and high speed push roads send the right product in the right order down conveyors which actually go right into a truck trailer. Loaders are at the bottom of the conveyors and rescan each product to validate that it is the correct item going to the correct customer on the correct load. The scan data also allows every selector to be tracked in terms of number of pieces selected by hour, same for the loaders, and in the event there is an error, the mis-selected can be traced back to the person who made the error (Lyon, 2010).

The truck is loaded and is dispatched at the proper time; orders are guaranteed to arrive within a two hour window, so customers can staff their receiving departments accordingly. All trucks are equipped with GPS scanning antennae so a truck is constantly “pinged” to make sure that it is running on time and on the proper route. This same data

can be accessed by the customer via the internet to find out where their truck is located exactly. When the delivery is made, the drivers scan the cases and totes as they are placed in the customer's store. If there is a missing or damaged case or item, the driver can issue an electronic credit immediately. The current standard which McLane has set for order error is .20% or 99.8% accuracy (Lyon, 2010).

Transitioning To RFID

While the current system is extremely efficient, McLane is always open to new and better technology. They aim to be on the forefront of the latest innovations. They want to not only stay competitive, but to stay ahead of their competitors by providing the best and most accurate service. They are always ready to adapt to change if it leads to better costumer service. The size and volume of an organization such as McLane makes it difficult to implement even a small system change, much less a total overhaul in its core distribution model.

Implementing an RFID system must be done by developing a business strategy that is well documented and defined. First the benefits of the new system must be communicated and discussed with business partners and customers. The system must be validated to ensure that customers understand how the system works and how it affects their business. Second the system must be rolled out in select waves and pilot programs. Customers that are interested in implementing and testing the new system should be the first to run pilot tests. The services and functions of the new system must be given a standard or goals and then method developed to ensure that these functions and objectives are met. Finally, documentation and data collection must be done to measure

the costs associated with the program. Sales and performance standards must be carefully analyzed and compared to previous results to obtain a benchmark.

It is the belief of McLane that a RFID system could increase their productivity in all areas. Items could be received quicker and placed in the proper bins with fewer errors. The same is true for production selection speed and finally delivery order rates. Perfect orders would be possible, and perfect orders mean high customer satisfaction. If one places a dollar value of running at a 99.8% accuracy rate, then the dollar impact from items that are either over, short or damaged equal over $60 million when the net sales are $30 billion per year.

The conversion to the use of RFID tags has started, but like any other enormous project faces many challenges. Not all manufacturers have the capital to invest in the equipment to affix the chip to their individual products. Other major issues are created when the USA continues to import goods from Third World Countries to save on product costs and sell at the lowest prices. Lower costs sometimes mean lesser adherence to our identification specifications. What are the hidden distribution costs associated with non-RFID labeled products?

The solution lies in several types of approaches. The first is one in which a separate third party company installs and operates the RFID equipment at the manufacturing site on a fee basis. The manufacturer would not have to make major capital investments and could pass along the costs to the consumer, or by maintaining their prices by recouping the costs by better managing the entire manufacturing process. Better data will both reduce raw or finished goods and more accurate sales data will aid them in producing inventory of what is selling.

Another solution is for distributors, such as McLane to provide the RFID chip for a fee, charging back the cost to the manufacturers. McLane could affix to every case or individual item a customized RFID chip which would be produced from blank chips. This process would replace what McLane is currently doing with their own label process but would require major capital investments in all their centers to use chips versus labels.

Chapter 5 - Conclusion

RFID technology has an important future role in the supply chain network. This paper has focused on consumer packaged goods, but similar savings, accuracy, and speed are applicable to numerous other classes of trade.

Any new system or technology requires capital, time, and planning to proceed. However the first real first step is to expose the merits of RFID technology to every segment of the supply chain, including the consumer.

This paper exposes and explores the details and benefits of this new technology, but in order to succeed, the term RFID must become a household word. A strong recommendation is that a joint committee should be formed by the companies who would most benefit from its implementation; silicon chip manufacturers, hardware manufactures, software development firms, etc. Their first order of business is to fund presentation and media materials that will educate and establish the benefits of this revolutionary new technology. All forms of media have to be controlled to deliver a consistent message. Keeping "consistent" as the main component, custom detailed versions have to be developed for every step in the supply management chain. The type of detail and benefits will be different for the manufactures, distributors, transporters, importers, retailers (national and independent), and finally the consumer.

Wal-Mart has already made progress in advancing the technology, which should give them a head start. Distributors, such as McLane, with existing automated platforms will also have an advantage over those employing manual techniques. This same advantage applies to previously mentioned manufactures, such as Proctor& Gamble, who are currently working with Wal-Mart by applying RFID chips to their top selling items.

The critical challenge is to educate the consumer as to what RFID technology is and how it will benefit them, stressing lower retail prices as the main outcome. All the Media used; print, radio, television, or internet based, has to be pro-active in anticipating questions and providing answers. Questions such as, "Are my personal shopping habits being divulged?" or "How do I know that I paid the right price for an individual item?" can be answered before the consumer can even ask them. The technology can be embraced and supported even before it reaches full roll out status.

The entire conversion process will take time, tests musts be run, mistakes made, and the resulting learning incorporated as solutions. However the final product will deliver a superior technology which will move the entire supply chain forward into the future; Better, Faster, Cheaper.

References:

Hardgrave, B., Waller, M., Miller R. Sam M. (June 2006) Does RFID Reduce Out of Stocks? A Preliminary Analysis Information Technology Research Institute, Sam M. Walton College of Business, University of Arkansas

Hugos, M., and Chris T., (2006) The Real-Time Supply Chain And Beyond". Supply Chain Management in the Retail Industry. John Wiley & Sons. 2006. Books24x7.

Albert, B. (September 2007) The UPC Turns 30: The Grocery Industry Celebrates The Birth Of The UPC Bar Code At The Site of the First Grocery Scanner Installation retrieved 6/24/09 from http://srdc.msstate.edu/ecommerce/curricula/rural_retailing/docs/upc_code.pdf

Read, R. (October, 2004) RFID gaining investment momentum retrieved 6/30/09 from http://wistechnology.com/articles/2349/

Garg V., Jones, C., and Sheedy C. (1997) 17 Billion Reasons to Say Thanks. The 25th Anniversary of UPC and It's Impact on the Grocery Industry retrieved 6/23/08 from http://barcodes.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?TabId=136&DMXModule=731&Command=Core_Download&EntryId=79&PortalId=0

BarCodes and eCom (2010) Frequently Asked Questions (FAQs) retrieved 7/4/09 from http://barcodes.gs1us.org/dnn_bcec/TabId/142/Default.aspx

Hardgrave, B., Miller R. Sam M. (February 2006) The Myths and Realities of RFID *International Journal of Global Logistics and Supply Chain Management*

Delen, D., Hardgrave, B., Sharda R., and Spears W., (1/2007) RFID for Better Supply-Chain Management through Enhanced Information Visibility Walton College of Business information Technology Research Institute

Corsten, D., and Gruen, T., "Desperately Seeking Shelf Availability: An Examination of The Extent, the Causes, and the Efforts to Address Retail Out-of-Stocks," *International Journal of Retail & Distribution Management*, 31 (11/12), 2003, 605-617.

Hardgrave, B., Waller, M. and Miller, R., (2006), "RFID's Impact on Out of Stocks: A Sales Velocity Analysis," White Paper, Information Technology Research. Institute, Sam M. Walton College of Business, University of Arkansas. Retrieved 4/1/09 from http://itrc.uark.edu/research/display.asp?article=ITRI-WP068-0606

Mentzer, J.T. et al. (2001): Defining Supply Chain Management, in: Journal of Business Logistics, Vol. 22, No. 2, 2001

RFID Journal Inc. (2005) A Summary of RFID Standards retrieved 6/1/09 from http://www.rfidjournal.com/article/view/1335/1

Chappell G., Ginsburg L., Schmidt P., Smith J, and Tobolski, J. (2003) Auto-ID on Demand: The Value of Auto-ID Technology in Consumer Packaged Goods Demand Planning

Berman J., Logistics Management,(3/30/2010) Supply chain: Wood pallets continue to be blamed for Tylenol recall McNeil Consumer Healthcare cites wooden pallets as cause for recall and outlines plan of action to remedy the problem. Retrieved 4/1/10 http://www.logisticsmgmt.com/article/454611-Supply_chain_Wood_pallets_continue_to_be_blamed_for_Tylenol_recall.php

Cadbury (2009) Profit Margins Report

Swamy G., Sarma, S., (February 1 2003) Manufacturing Cost Simulations for Low Cost RFID Systems. Distribution restricted to Sponsors until May 1, 2003.

Chappell G., Durdan D., Gilbert G., Ginsburg L, Smith J., and Tobolski J., (November 2003) Auto-ID on Delivery: The Value of Auto-ID Technology in the Retail Supply Chain Published November 1, 2002. Distribution restricted to Sponsors until February 1, 2003.

Agarwal V., (September 2001) Assessing the benefits of Auto-ID Technology in the Consumer Goods Industry Published September 1, 2001. Distribution restricted to sponsors until December 1, 2001.

Agarwal V. (2001) Assessing the benefits of Auto-ID Technology in the Consumer Goods Industry retrieved 8/1/19 from http://www.autoidlabs.org/single-view/dir/article/6/89/page.html

Alexander K., Birkhofer G., Gramling K., Kleinberger H., Leng S., Moogimane, D., and Woods, M. (June 2002) Focus on Retail: Applying Auto-ID to Improve Product Availability at the Retail Shelf Published June 1, 2002. Distribution restricted to Sponsors until September 1, 2002.

Poirier, Charles C., and McCollum, D., (2006). "RFID Strategic Implementation and ROI: A Practical Roadmap to Success. J. Ross Publishing. © 2006. Books24x7. http://common.books24x7.com.dml.regis.edu/book/id_21369/book.asp

Myerson, Judith M., (2007) RFID in the Supply Chain: A Guide to Selection and Implementation. Auerbach Publications. © 2007. Books24x7. http://common.books24x7.com.dml.regis.edu/book/id_16454/book.asp>

G. Swamy and Sarma S. (May 2003) Manufacturing Cost Simulations for Low Cost RFID systems

Weier, M. (2007) Wal-Mart Gets Tough On RFID Sam's Club suppliers required to use tags or face $2 fee. Retrieved 10/1/09 from http://www.informationweek.com/news/mobility/RFID/showArticle.jhtml?articleID=205900561

Supply Chain Digest (2009) RFID News: Looking Back at the Wal-Mart RFID Time Line relieved http://www.scdigest.com/assets/On_Target/09-02-23-1.php?cid=2275&ctype=content

Duvall, M. (2007) Wal-Mart's Faltering RFID Initiative retrieved http://www.baselinemag.com/index2.php?option=content&task=view&id=4120&pop=1&hide_ads=1&page=2&hide_js=1

Zebra (2007) Unchaining the Value of RFID How closed-loop systems provide flexibility and fast ROI retrieved http://www.zebra.com/id/zebra/na/en/documentlibrary/whitepapers/rfid_closed_loop.File.tmp/WP14344L_RFIDClosedLoop.pdf

Chappell G,, Ginsburg L, Schmidt P., Smith J., Tobolski J., (November 2002) Auto-ID on Demand: The Value of Auto-ID Technology in Consumer Packaged Goods Demand Planning

Jones T, J.J Jones (1998) McLane Company Job Book: Dock Receiver 1998 McLane Company

Grogman, Rodger. (2009, October 9). Corporate Vice President of Marketing (Retired), McLane Company. Phone Interview

Lyon, Daryyl. (2010, January 5). Vice President of Distribution, McLane Western. Interview

Kimborough, B. (2009 October 10) Corporate Vice President IS Development McLane Company. Phone Interview

RFID Journal (2002) RFID Business Applications retrieved 5/10/10 from http://www.rfidjournal.com/article/print/1334

Palmer, W. (December 2004) Understanding the Impact of RFID on Retail retrieved 5/13/10 from http://www.unisen.com/Security-Information/PDF/Impact-Of-RFID-On-Retail.pdf

Sharples H. (2005) Marketing Benefits Tops in RFID Adoption, Says Study DePaul University item-level study says marketing benefits outweigh those in warehousing, stocking cost reduction for retailers. Retrieved 5/13/10 from http://www.rfidproductnews.com/issues/2005.05/feature/marketingbenefits.php